The importance of working conditions and non-professional factors in the development of carpal tunnel syndrome

(Znaczenie warunków pracy i czynników pozazawodowych w powstawaniu zespołu cieni nadgarstka)

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Abstract – Introduction. The aetiology of the carpal tunnel syndrome (CTS) is very different and a large role is attributed to the mechanical factors leading to the narrowing of the carpal tunnel due to its excessive overload, which may result from the nature of performed work.
Aim of the study.The objective of the thesis was to present selected working conditions and non-professional factors in the development of carpal tunnel syndrome.
Selection of materials. The search was carried out in the Scopus database using the concepts of the carpal tunnel syndrome and professional and non-professional factors of the syndrome development in years 2000-2018. The literature found in the Google Scholar database was analysed in terms of the largest number of citations. Literature selected in this way served as the material for the thesis.
Conclusions. The development of the syndrome may be related to both the repetitiveness of movements and the effort of the hand made in their performance (strenuous effort).

Key words - carpal tunnel syndrome, importance of the working environment, non-professional factors.

Streszczenie – Wprowadzenie. Etiologia zespołu kanału nadgarstka (carpal tunnel syndrome - CTS) jest bardzo różna, w tym dużą rolę przypisuje się czynnikom mechanicznym doprowadzającym do zwężenia kanału nadgarstka, przy jego nadmiernym przeciążeniu, co może wynikać z charakteru wykonywanej pracy.
Cel pracy. Celem pracy było przedstawienie znaczenia wybranych warunków pracy i czynników pozazawodowych w powstawaniu zespołu cieni nadgarstka.
Dobór materiału. Poszukiwania przeprowadzono w bazie Scopus używając pojęć zespół kanału nadgarstka, czynniki zawodowe, czynniki pozazawodowe powstawania zespołu za okres 2000-2018r. Znalezione piśmiennictwo w bazie Google Scholar przeanalizowano pod kątem największej liczby cytowań. Tak wyselekcjonowane piśmiennictwo posłużyło za materiał do opracowania niniejszej pracy.
Wnioski. Ryzyko rozwoju zespołu może być powiązane zarówno z powtarzalnością ruchów, jak i wysiłkiem ręki przy ich wykonywaniu (forsownym wysiłkiem).

Słowa kluczowe – zespół kanału nadgarstka, znaczenie środowiska pracy, czynniki pozazawodowe.

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I. INTRODUCTION

The aetiology of the carpal tunnel syndrome (CTS) is very different and a large role is at-tributed to the mechanical factors leading to the narrowing of the carpal tunnel due to its ex-cessive overload, which may result from the nature of performed work. [1-4]

The aim of the study was to present selected working conditions and non-professional factors in the development of carpal tunnel syndrome.

II. SELECTION OF MATERIALS

The search was carried out in the Scopus database using the concepts of the carpal tunnel syndrome and professional and non-professional factors of the syndrome development in years 2000-2018. The literature found in the Google Scholar database was analysed in terms of the largest number of citations. Literature selected in this way served as the material for the thesis.

III. THE ROLE OF PROFESSIONAL RISK FACTORS

Activities that may be conducive to the development of CTS and are related to the performed work are, among others [1-4]:

- typing on a computer keyboard,
- typing on a writing machine,
- playing the piano,
- routine assembly of electronic parts,
- working at the supermarket checkout,
- hairdressing,
- knitting or sewing,
- working in the garden (digging, weeding);
- working as a car mechanic.

Repeated activities related to flexing the wrist and fingers also apply to playing musical instruments, riding a bicycle or moving about on crutches.

The development of CTS may be also caused by vibrations transmitted to the upper extremity from mechanical devices. Therefore, it is often emphasized that the development of CTS is influenced by many factors that may be related to the patient's work, especially physical work performed with the use of mechanical vibrating tools, mainly pneumatic hammer, electric drill or grinder. Frequent use of vibrating devices increases the risk of CTS 7 times. In a similar way, the development of CTS is induced by the performance of activities that require constant, repetitive, excessive movements of the wrist. Such movements are involved, for example, in the profession of a tailor, in which the risk of CTS increases twice compared to the rest of the population.[5,6]

IV. REPEATABILITY OF MOVEMENT AS A RISK OF CTS

An increase in the pressure in carpal tunnel can lead to disturbances of nerve blood supply. In the initial period, disturbances of the conductivity in myelin nerve fibres occur, which in turn may lead to the death of axons. Pressure on the nerve causes paraesthesia of the palmar-radial part of the hand and pain around the wrist and hand.[2,6,7] At times, depending on the place of pressure, the symptoms may also appear in the area of the forearm or shoulder. The risk of symptomatic CTS is associated with the performance of repetitive specific activities and hand movements associated with [8,9,10]:

- the frequency of performing typical activities with your hands,
- the duration of typical hand activities,
- the relation between the time of work performed with hands and the break duration,
- the percentage of repeatable activities in the whole working time,
- the number of products produced per time unit.

Taking into account all the major CTS risk factors, the development of the syndrome may be related to both the repetitiveness of movements and the effort of the hand made in their performance (strenuous effort). [8,10]

It is assumed that the repeatability of moves is high when the cycle lasts less than 30 seconds or if the same operations are repeated in 50% of the cycle.

The necessity of using force during manual work, defined as strenuous effort of hands, is in turn defined as exerting a strong hand force or using a hand to hold, hit or pull objects, which also applies to manipulating these objects.

There is evidence that there is a relationship between high repeatability of work and the risk of CTS. This risk is increased by a specific position of the wrist while performing hand activities, but this is important mainly in the wrong position of the wrist with the excessive force that accompanies it. [7,11,12]

V.BODY POSITION AS A CTS RISK FACTOR

Risks in the formation of CTS also include the position of the body. It turns out that work carried out in an extremely uncomfortable position for a person is connected with the natural necessity of using much more power to perform the activity. It should be emphasised that the time in which the employee must maintain an inconvenient and troublesome position is extremely important in this case. A comparison of three groups of employees who performed their activities in the extreme position of the wrist for 17 to 40 hours proved that the risk of CTS increased from 1.5 to 8.7 times. [2,3,11]

VI. METHOD OF PERFORMING WORK AND RISK OF CTS

CTS is sometimes treated as an occupational disease. The most visible relationship between the occurrence of CTS and the performed work was observed where several risk factors were present at the same time. These are the cases in which the movements are accompanied by a sufficiently high strength and repeatability of the activity, as well as when the movements are carried out with the participation of a large force and the wrong position of the wrist.[2,11,13]

The risk of CTS occurrence increases with insufficient equipment of a single work station, which most often concerns the manual delivery of materials or objects subjected to subsequent treatment and the lack of rotation between individual positions.

Activities requiring repetitive movements, with the participation of a considerable force, for example in compression, increase the risk of CTS development up to 61%. Such a risk applies to the professions of a grinder, butcher (concerns the activity of separating meat from bone), employee of cold stores or grocery stores. [2,3,14]

Significantly lower risk of CTS applies to people employed in chemical plants whose work does not require performing activities straining the upper limbs so much.

The relatively highest frequency of CTS occurrence is observed among employees who perform fast finger movements, which mainly involve bending. In addition, this risk is raised by obesity and occupational stress. High frequency of the same movements and the use of significant force increases the risk of CTS. The frequency of movements is of greater importance for the syndrome development, while the use of excessive force of a lesser significance. Research carried out in various occupational groups (medical personnel, industry workers and housewives) indicates that when performing work using considerable force and low frequency of movements, the risk of CTS development is 20% lower than in people who use low strength, but their the work consists in high repetition of specific activities using the upper extremity. [2-4,15]

Another example of the above thesis are observations of employees who deal with the assembly of small components on the belt (the risk of occurrence of CTS concerns 13.4% of this group), employees involved in sewing clothing and footwear (risk of CTS affecting 12.1% of this group), people employed in food industry (the risk of occurrence of CTS affects 6.8% of this group) and people involved in packaging of products (the risk of CTS affects 16.2%). At the same time, in the group of people who do not perform heavy work using their upper limbs, the risk of CTS is only 3.6%. Other occupations with virtually no risk of CTS occurrence involve secretarial staff and quality control personnel (the risk of CTS is 2.4% in this group). [2,16]

Among the risk factors for the development of CTS, the duration of individual tasks is of particular importance, and the shorter the activity (less than 10 seconds), the greater the risk of CTS. [2,3]

Another important risk factor for the CTS syndrome is age (the highest risk of developing CTS affects the age group from 40 to 49), overweight (mainly obesity), psychological problems, low levels of self-control, as well as chronic stress and rush [2,3,10,11]

Research conducted in the 1980s in the US in the state of Washington on 8,000 employees of the food industry proved that CTS appeared almost 15 times more often in packagers and sellers (performing very similar activities on a daily basis) than people doing work in other professions. In addition, food producers, including mainly eggs, vegetables and fruit, employees of canned fish factories, carpenters and tailors turned out to be more exposed to the risk of CTS. [2,15]

Another professional group in which there is a relatively high risk of CTS development are healthcare workers, in particular nurses, the staff of operating rooms, dental assistants and hygienists. [2,6]

VII.INFALLIBLE CTS OCCURRENCE FACTORS

Considering the factors unrelated to the performed work, CTS is most often caused by pathologies associated with changes in the carpal tunnel architecture, including the swelling of tissues causing excessive pressure on the median nerve. These factors shall include: rheumatoid arthritis, Colles fracture (fracture of the proximal radial bone with displacement) and obesity.[2,6,9]

CTS may also develop as a result of hormonal changes (disorders), e.g. hypothyroidism (the incidence of CTS symptoms increases even in a patient treated for hypothyroidism), diabetes, bilateral ovariectomy, but also during menopause, in following hormonal replacement therapy, as a result of the use of oral contraceptives, and during pregnancy. [2,6,16]

It is indicated that the development of CTS may be favoured by a small wrist, and thus by small spaces in the carpal tunnel. This factor is to be important mainly for the development of CTS in women.

Another important risk factor for CTS is excessive body weight, which can increase the probability of CTS syndrome development in obese people much more frequently than in slim ones. On this basis, a direct relationship was found between the development of CTS and overall body weight.

The emergence and development of CTS is also associated with the patient's lifestyle. This risk is increased by the consumption of excessive amounts of caffeine, alcohol and by smoking.

Hypercholesterolemia (excessive cholesterol, which affects the course of fibrinogenesis, increasing the proliferation of connective tissue in the median nerve) is also mentioned among the individual risk factors for the CTS occurrence. [2-4,6,9,16]

VIII. REFERENCES

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